



EXPERTS TALK

Bridge Design Innovation with Manuel Carballo

Learn how your approach leads to innovation. Bridge design is evolving and dependent on the people who drive it.

The nuts and bolts of bridge design is big business in our modern era. As commuters' lives become busier and their time becomes more of a commodity, duration and resource efficiencies are key components to the completion of major bridge projects. Fortunately, design innovation has replaced more traditional methods to enable engineers to produce bridges with enhanced durability and sustainability — and in less time than ever before.



"Because we've always done it this way," is not part of our Central Region Principal Bridge Engineer Manuel Carballo's vocabulary. His perspective is one of many that helped us build a forward-thinking and successful bridges and structures practice that

made us ENR's No. 1 bridge design firm in 2017. It also made him a top choice for our first interview topic: "Design Innovation."

Manuel has 32 years of industry experience and has contributed to many complex bridge projects, including the current \$2.3 billion [I-4 Ultimate program](#) in Central Florida. Contact [Manuel Carballo](#) for more information on bridge design innovation.

Q. You're at dinner with a client following a full day of learning at conference presentations. The topic turns to "design innovation." How would you define it based on your project experience?

A. Design innovation is the integration of new technologies, structure types and materials in the design process to help clients enhance safety, durability, sustainability, and/or to reduce construction costs and durations.

Q. In general, conversational terms, what do bridge engineers mean when they say "design innovation"?

A. We mean a design decision that opts away from traditional methods or materials in favor of less traditional ones in order to positively influence project outcomes. Our clients expect bridges that are durable, cost-effective, and capable of being built safely and quickly. As designers, we should always be evaluating new materials and technologies for potentially beneficial applications to our projects. The "innovation" part comes from understanding how and when and where to apply something less traditional, and thereby capture greater value for the client.

Q. What makes a smart design decision a true “design innovation”?

A. If a nontraditional design decision helps a community move closer to a goal than a more traditional approach would have, it’s a design innovation. Project engineers have to look at projects more holistically sometimes to see the difference, to see a thriving bridge project as a key element of a healthy community.

As designers, we are primarily focused on the “nuts and bolts,” but we should think beyond that. Our clients and the end users of our projects — the traveling public — view bridges we design through a different lens. They expect good engineering, but are not especially concerned with how detailed our spreadsheets are nor how fast our computer programs run; they want durable structures that support vibrant communities, better mobility and greater quality of life. If a nontraditional design decision helps a project move a community further toward one of these goals, it’s a true innovation.

Q. What obstacles can hinder design innovation?

A. In our industry, it is not uncommon to hear “we do it this way because we have always done it like this.” Sometimes we are unwilling to consider new ideas. It is important that, as an industry of owners, contractors, vendors and engineers, we create conditions in which innovation can thrive. We each play a key role in the development of projects and should be interested in innovative thinking and working together to advance new technologies.

Q. What’s a recent example of design innovation in your own work?

A. The 2nd Avenue Bridge replacement project is part of Michigan Department of Transportation’s widening of Interstate 94, and our bridge design is not only innovative, it will be a first in the U.S.

The bridge crosses a depressed section of I-94 in downtown Detroit; this area sees extremely high traffic volumes, and it’s in close proximity to an adjacent interchange, thus making a built-in-place bridge solution nearly impossible.

The new bridge is also flanked by a historic property on one corner, and it’s constrained by local streets on each end of the bridge, so a shallow superstructure depth was desired to facilitate tie-ins at both ends. Furthermore, key stakeholders requested a unique and visually striking bridge to serve as a “community connector” structure at this location.

Working closely with MDOT and key stakeholders, our design team developed an innovative skewed arch configuration

and eliminated all bracing between the arch ribs to simplify fabrication and preserve the attractive appearance of the bridge.

To construct the bridge safely and without long-term traffic impacts to I-94, the arch span will be assembled in a nearby parking lot and moved into place in a single overnight closure of the freeway. This move will take place using self-propelled modular transporters — sets of multi-axle trailers that can lift the entire 2,400 ton arch span, carry it to its final location and lower it safely into place on the abutments.



By thinking holistically and using innovative thinking, we will deliver a bridge that:

- Deploys the first skewed, unbraced network arch in the United States
- Is the first unbraced arch in the U.S. to be moved over an existing roadway using SPMTs
- Clear-spans I-94
- Is a unique, signature structure
- Can be built with minimal impacts to I-94 traffic
- Has a shallow superstructure depth that facilitates tie-ins at both ends



Inspiration & Advice

Q. What inspired you to become a bridge engineer?

A. My dad was an avid reader of the National Geographic Magazine, and when I was in grade school the magazine featured an article on New York City skyscrapers. The cover was a photo of some of the most famous buildings and bridges in NYC. I was fascinated with how something so big could be built. That striking photo led down the path of becoming a structural engineer.

Q. What advice do you have for bridge designers who are new to the profession?

A. College gives us the basic tools, but to be a successful bridge engineer there are additional steps you need to take:

- Bridges come in many sizes and shapes. Appreciate all of them; you will learn something new with every project.
- Work on your communication skills. As engineers, we need to be good communicators with our clients, the public, contractors and other engineers.
- Be a team player. The most successful projects are done by teams.
- Don't be afraid to ask questions. Chances are someone in your organization has already done it.
- You're responsible for your career. Take the initiative and make your own time more productive by reading self-help books and learning new skills.

Experts Talk is an interview series with technical leaders from across our Transportation program. Each interview illuminates a different aspect of transportation infrastructure planning, design and delivery. Contact HDRTransportation@hdrinc.com for more information. Visit www.hdrinc.com/insights regularly to gain insights from specialized experts and thought leaders behind our award-winning, full service consulting practice.